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DEPARTMENT OF THE ARMY

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TULSA DISTRICT, CORPS OF ENGINEERS

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<HL4>TULSA DISTRICT GUIDE SPECIFICATION</HL4>

<HL4>Includes changes through Notice 2 (February 1996)</HL4>

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<SCN>SECTION 07416</SCN>

<STL>STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM</STL>

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<NPR>NOTE: This guide specification covers the requirements for <SCP>both factory color and mill finish SSSMR systems</SCP>. This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-720.</NPR>

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</NTE><PRT><TTL>PART 1 GENERAL</TTL>

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<NPR>NOTE: This guide specification will be used in the preparation of project specifications for SSSMR systems. SSSMR is a system of metal roof panels supported and/or attached by clips fastened directly to the building structure. For non-structural standing seam metal roof systems or sheet metal cladding, use Section 07413 METAL ROOFING AND SIDING.</NPR>

<NPR>This guide specification will be used in conjunction with Section 13120 STANDARD METAL BUILDING SYSTEMS or Section 13121 SPECIAL PURPOSE METAL BUILDING SYSTEMS when a SSSMR is required for that type of construction.</NPR>

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</NTE><SPT><TTL>1.1 REFERENCES</TTL>

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<NPR>NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification.</NPR>

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</NTE><TXT INDENT=0 p>The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.</TXT>

<REF><ORG>ALUMINUM ASSOCIATION (AA)</ORG>

<RID>AA-01</RID><RTL>(1993) Aluminum Standards and Data</RTL>

<RID>AA SAS-30</RID><RTL>(1986) Aluminum Construction Manual Series -
Section 1 Specifications for Aluminum
Structures</RTL>

</REF><REF><ORG>AMERICAN INSTITUTE OF STEEL CONSTRUCTIO
(AISC)</ORG>

<RID>AISC-04</RID><RTL>(1989) Specification for Structural Steel Buildings
- Allowable Stress Design and Plastic
Design</RTL>

</REF><REF><ORG>AMERICAN IRON AND STEEL INSTITUTE (AISI)</ORG>

<RID>AISI SG-673</RID><RTL>(1986; Addenda 1989) Cold-Formed Steel Design
Manual</RTL>

</REF><REF><ORG>AMERICAN SOCIETY FOR TESTING AND MATERIAL
(ASTM)</ORG>

<RID>ASTM A 463</RID><RTL>(1994) Steel Sheet, Cold-Rolled, Aluminum-Coated,
Type 1 and Type 2</RTL>

<RID>ASTM A 653</RID><RTL>(1994) Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy - Coated (Galvannealed) by
the Hot-Dip Process</RTL>

<RID>ASTM A 792</RID><RTL>(1993) Steel Sheet, Aluminum-Zinc Alloy-Coated by
the Hot-Dip Process</RTL>

<RID>ASTM B 117</RID><RTL>(1994) Salt Spray (Fog) Testing</RTL>

<RID>ASTM B 209</RID><RTL>(1993) Aluminum and Aluminum-Alloy Sheet and
Plate</RTL>

<RID>ASTM C 518</RID><RTL>(1991) Steady-State Heat Flux Measurements and
Thermal Transmission Properties by Means of
the Heat Flow Meter Apparatus</RTL>

<RID>ASTM C 553</RID><RTL>(1992) Mineral Fiber Blanket Thermal Insulation
for Commercial and Industrial
Applications</RTL>

<RID>ASTM C 612</RID><RTL>(1993) Mineral Fiber Block and Board Thermal
Insulation</RTL>

<RID>ASTM C 1289</RID><RTL>(1995) Faced Rigid Cellular Polyisocyanurate
Thermal Insulation Board</RTL>

<RID>ASTM D 522</RID><RTL>(1993a) Mandrel Bend Test of Attached Organic
Coatings</RTL>

<RID>ASTM D 523</RID><RTL>(1989) Specular Gloss</RTL>

<RID>ASTM D 714</RID><RTL>(1987; R 1994) Evaluating Degree of Blistering of
Paints</RTL>

<RID>ASTM D 968</RID><RTL>(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive</RTL>

<RID>ASTM D 1308</RID><RTL>(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes</RTL>

<RID>ASTM D 1654</RID><RTL>(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments</RTL>

<RID>ASTM D 2244</RID><RTL>(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates</RTL>

<RID>ASTM D 2247</RID><RTL>(1994) Testing Water Resistance of Coatings in 100 Percent Relative Humidity</RTL>

<RID>ASTM D 2794</RID><RTL>(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)</RTL>

<RID>ASTM D 3359</RID><RTL>(1995) Measuring Adhesion by Tape Test</RTL>

<RID>ASTM D 4214</RID><RTL>(1989) Evaluating the Degree of Chalking of Exterior Paint Films</RTL>

<RID>ASTM D 4397</RID><RTL>(1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications</RTL>

<RID>ASTM E 84</RID><RTL>(1994a) Surface Burning Characteristics of Building Materials</RTL>

<RID>ASTM E 96</RID><RTL>(1994) Water Vapor Transmission of Materials</RTL>

<RID>ASTM E 1592</RID><RTL>(1994) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference</RTL>

<RID>ASTM G 23</RID><RTL>(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials</RTL>

</REF><REF><ORG>AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)</ORG>

<RID>ASCE 7</RID><RTL>(1993) Minimum Design Loads for Buildings and Other Structures</RTL>

</REF><REF><ORG>FEDERAL SPECIFICATIONS (FS)</ORG>

<RID>FS HH-I-1972/GEN</RID><RTL>(Basic; Am 1; Notice 1) Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate</RTL>

<RID>FS HH-I-1972/1</RID><RTL>(Basic; Notice 1) Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam</RTL>

</REF><REF><ORG>METAL BUILDING MANUFACTURERS ASSOCIATIO
(MBMA)</ORG>

<RID>MBMA-01</RID><RTL>(1986; Errata; Supple 1990) Low Rise Building
Systems Manual</RTL>

</REF><REF><ORG>STEEL JOIST INSTITUTE (SJI)</ORG>

<RID>SJI-01</RID><RTL>(1994) Standard Specifications Load Tables and Weight
Tables for Steel Joists and Joist
Girders</RTL>

</REF></SPT><SPT><TTL>1.2 GENERAL REQUIREMENTS</TTL>

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<NPR>NOTE: Metal roof panels are capable of spannin
the structural supports and resisting snow, dead,
live, concentrated, and wind loads without benefit of
additional substrate materials.</NPR>

<NPR>For Government designed buildings the contrac
drawings will show structural framing, bracing, and
supports to receive the SSSMR system. The contract
drawings will also include loading diagrams/tables
showing the design wind uplift pressures for all zones
as determined by ASCE 7. The contract drawings will
also include snow loading diagrams/tables where
appropriate. The roof slope will be indicated on the
drawings. Roof slopes will be specified in accordance
with TM 5-809-2. SSSMR system must be designed to
accommodate effects of ice damming and other
conditions in cold climates.</NPR>

<NPR>Since there is a wide variety in roof syste
configuration, fastening systems, and accessories,
excessive detailing of the roof system will be
avoided.</NPR>

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<TXT INDENT=0 p>1.2.1 Work Included</TXT>

<TXT INDENT=0 p>The structural standing seam metal roof (SSSMR)system shal
include all exposed metal roof and components associated with the SSMRS.
Associated components shall include include flashing, trim, caps, closure
and end pieces, and metal gutter and downspout system and shall be furnished
by the SSMRS manufacturer. All exposed metal portions shall be prefinished
metal matching the roof panels. Prefinished flush seam metal wall panels is
specified in Section 07413 - METAL SIDING. Concealed flashing and other
sheet metalwork not associated with SSMRS is specified in Section 07600 -
SHEET METALWORK; GENERAL. </TXT>

</SPT><SPT><TTL>1.3 DESIGN REQUIREMENTS</TTL>

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<NPR>NOTE: When the SSSMR system is a component of
metal building system, the loading criteria specified
in Section 13120 STANDARD METAL BUILDING SYSTEMS or

Section 13121 SPECIAL PURPOSE METAL BUILDING SYSTEMS will apply and these paragraphs will be coordinated accordingly. A reference to the pertinent Section will be made for design conditions, and applicable paragraphs of Section 13120 or Section 13121 will be edited accordingly.</NPR>

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</NTE><TXT INDENT=0 p>The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same manufacturer.</TXT>

<SPT><TTL>1.3.1 Design Criteria</TTL>

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<NPR>NOTE: Select either MBMA-01 or ASCE 7 as appropriate. The designer will provide loading diagrams/tables on the contract drawings, plus dimensions of edge, eave, ridge and corner zones. Loads will be calculated in accordance with ASCE 7 for conventionally designed and for special purpose metal building systems, and MBMA-01 for standard metal building systems.</NPR>

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</NTE><TXT INDENT=0 p>Design criteria shall be in accordance with [<RID>MBMA-01</RID>] [<RID>ASCE 7</RID>] unless otherwise specified.</TXT>

</SPT><SPT><TTL>1.3.2 Dead Loads</TTL>

<TXT INDENT=0 p>The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.</TXT>

</SPT><SPT><TTL>1.3.3 Live Loads</TTL>

<SPT><TTL>1.3.3.1 Concentrated Loads</TTL>

<TXT INDENT=0 p>The panels and concealed anchor clips shall be capable of supporting a <MET>1335 N</MET> <ENG>300 pound</ENG> temporary concentrated load at the panel midspan in the installed condition. The load shall be applied over the entire panel width. The panels shall support this concentrated load without displaying permanent distortions that would affect the weathertightness of the SSSMR system.</TXT>

</SPT><SPT><TTL>1.3.3.2 Uniform Loads</TTL>

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<NPR>NOTE: The minimum roof live load will be no less than 960 Pa (20 psf).</NPR>

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</NTE><TXT INDENT=0 p>The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of <MET>[960] [_____] Pa.</MET> <ENG>[20] [_____] psf.</ENG></TXT>

</SPT></SPT><SPT><TTL>1.3.4 Roof Snow Loads</TTL>

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<NPR>NOTE: Snow load, including unbalanced roof snow loads and drift load shall be calculated in accordance with ASCE 7 or MBMA-01.</NPR>

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</NTE><TXT INDENT=0 p>The design roof snow loads shall be as shown on the contract drawings.</TXT>

</SPT><SPT><TTL>1.3.5 Wind Loads</TTL>

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<NPR>NOTE: The internal pressure coefficient for conventionally designed buildings and for special purpose metal building systems will be determined based on the combination of open and closed doors and windows which produce the greatest wind loadings. The minimum internal pressure coefficient will be +0.25. The internal pressures also apply to SSSMR systems above substrates since the panels do not lay directly on the substrate.</NPR>

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</NTE><TXT INDENT=0 p>The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.</TXT>

<ITM INDENT=-23.75 p>a. Single fastener in each connection.....3.0</ITM>

<ITM INDENT=-23.75 p>b. Two or more fasteners in each connection...2.25</ITM>

</SPT><SPT><TTL>1.3.6 Thermal Loads</TTL>

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<NPR>NOTE: Select appropriate temperature range based on effects of direct sun and general climatic conditions of the project site.</NPR>

<NPR>Insulated structures experience greater temperature differences than that of uninsulated structures. For specific projects, giving consideration to the panel color, building location, infrared heating by the sun, and the cooling effect of the roof radiating into the night sky, the designer should use a maximum temperature range of 122 degrees C (220 degrees F) for an insulated building and a maximum temperature range of 89 degrees C (160 degrees F) for an uninsulated building to compensate for the

differential movement between the roof panels and the structural framework.</NPR>

<NPR>For wood structures, insulated buildings that are temperature sensitive, or in extreme climate areas, a greater temperature range should be considered. Dark roofs in mountain areas may be subject to a temperature range of 133 degrees C (240 degrees F) or more. For lateral expansion the thermal movement may be assumed to be absorbed in the standing seam rib.</NPR>

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</NTE><TXT INDENT=0 p>Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of <MET>[_____] degrees C</MET> <ENG>[_____] degrees F</ENG> during the life of the structure.</TXT>

</SPT><SPT><TTL>1.3.7 Framing Members Supporting the SSSMR System</TTL

<TXT INDENT=0 p>Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with [<RID>AISC-04</RID>] [<RID>AISI SG-673</RID>] [<RID>SJI-01</RID>]. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.</TXT>

</SPT><SPT><TTL>1.3.8 Roof Panels</TTL

<TXT INDENT=0 p>Steel panels shall be designed in accordance with <RID>AISI SG-673</RID>. Aluminum panels shall be designed in accordance with <RID>AA-01</RID>. Section modulus and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with <RID>AA SAS-30</RID>. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.</TXT>

</SPT><SPT><TTL>1.3.9 Accessories and Fasteners</TTL

<TXT INDENT=0 p>Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. A minimum of two fasteners per clip shall be provided. Single fasteners with a minimum diameter of <MET>9 mm</MET> <ENG>3/8 inch</ENG> may be provided when the supporting structural members are prepunched or predrilled.</TXT>

</SPT></SPT><SPT><TTL>1.4 PERFORMANCE REQUIREMENTS</TTL

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<NPR>NOTE: Testing is required to verify the adequacy of the SSSMR system. External reinforcement of panel seams is not permitted, except when approved by the customer and the designer. Consider the use of closer purlin spacing and/or narrow width panels (305 mm (12 inches)) in order to eliminate the need for external reinforcement. External reinforcement includes clips, and clamps on the ribs or seams.</NPR>

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</NTE><TXT INDENT=0 p>The SSSMR shall be tested for wind uplift resistance in accordance with <RID>ASTM E 1592</RID>. SSSMR systems previously tested and approved by the Corps of Engineer's STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. One test shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be<MET>750 mm.</MET> <ENG>30 inches.</ENG> The second test shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be <MET>1.5 </MET>m<ENG>5.0 feet</ENG>. External reinforcement such as clamps on the ribs, [may] [shall not] be installed to improve uplift resistance. Bolts through seams shall not be installed for any reason.</TXT>

</SPT><SPT><TTL>1.5 SUBMITTALS</TTL>

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<NPR>NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.</NPR>

<NPR>Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.</NPR>

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</NTE><TXT INDENT=0 p>Government approval is required for submittals with "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section <SRF>01300</SRF> SUBMITTAL PROCEDURES:</TXT>

<LST INDENT=0 p>_{SD-01 Data}</LST>

<TXT INDENT=0 p>_{Design Analysis}; _{GA}.</TXT>

<TXT INDENT=0 p>Design analysis signed by a Registered Professional Engineer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components. The design analysis shall include calculations and indicate how expected thermal movements are accommodated.</TXT>

<LST INDENT=0 p>_{SD-04 Drawings}</LST>

<TXT INDENT=0 p>_{Structural Standing Seam Metal Roof System};
_{GA}.</TXT>

<TXT INDENT=0 p>Contractor's drawings and specifications; and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealant(s) and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required.</TXT>

<LST INDENT=0 p>_{SD-08 Statements}</LST>

<TXT INDENT=0 p>_{Qualifications}; _{GA}.</TXT>

<TXT INDENT=0 p>Qualifications of the manufacturer, manufacturer's representative, and installer. Proof of evidence of the installer training and certification by the manufacturer.</TXT>

<LST INDENT=0 p>_{SD-09 Reports}</LST>

<TXT INDENT=0 p>_{Test Report for Uplift Resistance of the SSSMR};
_{GA}.</TXT>

<TXT INDENT=0 p>To verify that the SSSMR system tested is the same as that proposed for this project, the report shall include the following information:</TXT>

<ITM INDENT=-23.75 p>a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.</ITM>

<ITM INDENT=-23.75 p>b. Details of the anchor clip, dimensions, and thickness.</ITM>

<ITM INDENT=-23.75 p>c. Type of fasteners, size, and the number required for each connection.</ITM>

<ITM INDENT=-23.75 p>d. Purlins/subpurlins size and spacing used in the test.</ITM>

<ITM INDENT=-23.75 p>e. Description of the seaming operation including equipment used.</ITM>

<ITM INDENT=-23.75 p>f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.</ITM>

<ITM INDENT=-23.75 p>g. Any additional information required to identify the SSSMR system tested.</ITM>

<ITM INDENT=-23.75 p>h. Signature and seal of an independent registered engineer who witnessed the test.</ITM>

<LST INDENT=0 p>_{SD-13 Certificates}</LST>

<TXT INDENT=0 p>_{Structural Standing Seam Metal Roof System};
_{FIO}.</TXT>

<ITM INDENT=-23.75 p>a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips comply with specified requirements.</ITM>

<ITM INDENT=-23.75 p>b. Certification that materials used in the installation are mill certified.</ITM>

<ITM INDENT=-23.75 p>c. Certification of SSSMR system previously tested under the Corps of Engineers' Standard Test Method if used in lieu of <RID>ASTM E 1592</RID> testing.</ITM>

<ITM INDENT=-23.75 p>d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.</ITM>

<TXT INDENT=0 p>_{Insulation}; _{FIO}.</TXT>

<TXT INDENT=0 p>Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.</TXT>

<LST INDENT=0 p>_{SD-14 Samples}</LST>

<TXT INDENT=0 p>_{Accessories}; _{GA}.</TXT>

<TXT INDENT=0 p>One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.</TXT>

<TXT INDENT=0 p>_{Roof Panels}; _{GA}.</TXT>

<TXT INDENT=0 p>One piece of each type to be used, <MET>225 mm</MET> <ENG>9 inches</ENG> long, full width.</TXT>

<TXT INDENT=0 p>_{Factory Color Finish}; _{GA}.</TXT>

<TXT INDENT=0 p>Three <MET>75 by 125 mm</MET> <ENG>3 by 5 inches</ENG> samples of each type and color.</TXT>

<TXT INDENT=0 p>_{Fasteners}; _{FIO}.</TXT>

<TXT INDENT=0 p>Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.</TXT>

<TXT INDENT=0 p>_{Insulation}; _{FIO}.</TXT>

<TXT INDENT=0 p>One piece, <MET>300 by 300 mm,</MET> <ENG>12 by 12 inches,</ENG> of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.</TXT>

<TXT INDENT=0 p>_{Gaskets and Insulating Compounds};
_{FIO}.</TXT>

<TXT INDENT=0 p>Two samples of each type to be used and descriptive data.</TXT>

<TXT INDENT=0 p>_{Sealant}; _{FIO}.</TXT>

<TXT INDENT=0 p>One sample, approximately <MET>0.5 kg,</MET> <ENG>1 pound,</ENG> and descriptive data.</TXT>

<TXT INDENT=0 p>_{Concealed Anchor Clips}; _{FIO}.</TXT>

<TXT INDENT=0 p>Two samples of each type used.</TXT>

<TXT INDENT=0 p>_{Subpurlins}; _{FIO}.</TXT>

<TXT INDENT=0 p>One piece, <MET>225 mm</MET> <ENG>9 inches</ENG> long.</TXT>

<TXT INDENT=0 p>_{EPDM Rubber Boots}; _{FIO}.</TXT>

<TXT INDENT=0 p>One piece of each type.</TXT>

<TXT INDENT=0 p>1.6 DELIVERY AND STORAGE</TXT>

<TXT INDENT=0 p>Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for roof covering shall provide good air circulation and protection from surface staining.</TXT>

</SPT><SPT><TTL>1.6 CONTRACTOR QUALIFICATIONS</TTL>

<SPT><TTL>1.6.1 Manufacturer </TTL>

<TXT INDENT=0 p>The SSSMR system shall be the product of a recognized manufacturer who has been in the practice of manufacturing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project. The SSSMR shall be the product of one of the following manufacturers.</TXT>

- <LST INDENT=0 p>1. Butler Manufacturing</LST>
- <LST INDENT=0 p>2. Berridge Manufacturing Co.</LST>
- <LST INDENT=0 p>3. Centria/H.H. Robertson Co.</LST>
- <LST INDENT=0 p>4. Morin Corporation</LST>
- <LST INDENT=0 p>5. MBCI</LST>
- <LST INDENT=0 p>6. Merchant & Evans</LST>

<TXT INDENT=0 p>The SSMR naming of the above manufacturers does not relieve any requirement for the manufacturer's product to comply with all other specification provisions herein.</TXT>

</SPT><SPT><TTL>1.6.2 Manufacturer's Representative </TTL>

<TXT INDENT=0 p>A representative of the SSMRS manufacturer, who is familiar with the design of the roof system supplied and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site at all times during installation of the

SSMRS to assure that the roof system meets the specified requirements. The manufacturer's representative shall be either an employee of the manufacturer with at least two years experience in installing the roof system or an employee of an independent installer that is certified by the SSMRS manufacturer to have two years of experience installing similar roof systems. </TXT>

</SPT><SPT><TTL>1.6.3 Installer </TTL>

<TXT INDENT=0 p>The installer shall have a minimum of 2 years experience and shall have been involved in installing at least 3 projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer shall be trained and/or certified by the manufacturer to install the particular roof system specified. Training and certification shall be defined to include formal hands-on training given by the manufacturer in the installation of the specified roofing system. The training program shall have been in existence for not less than one year and shall include, but not be limited to the following: a specific course outline describing the goals of the training program and how those goals are met by the training; pertinent quality control methods of installation; and means of correcting work not meeting contract requirements. </TXT>

<TXT INDENT=0 p>The following manufacturers are known to have training/certification programs which comply with the foregoing requirement: </TXT>

1. Butler

<LST INDENT=0 p>2. Merchant & Evans </LST>

<LST INDENT=0 p>3. Centria/H.H. Robertson</LST>

</SPT></SPT><SPT><TTL>1.7 GUARANTEE</TTL>

<TXT INDENT=0 p>The SSSMR system shall be guaranteed for 20 years against leakage arising out of or caused by ordinary wear and tear by the elements. The color finish shall be guaranteed for 20 years by the standard "Kynar" or other coating system proprietary warranty. Such guarantees shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.</TXT>

</SPT></PRT><PRT><TTL>PART 2 PRODUCTS</TTL>

<SPT><TTL>2.1 _{ROOF PANELS}</TTL>

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<NPR>NOTE: See TM 5-809-2 for guidance on roof slope and height of seams.</NPR>

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</NTE><TXT INDENT=0 p>Panels shall be either steel or aluminum and shall have a [factory color] [mill] finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when such slope is <MET>9000 mm</MET> <ENG>30 feet</ENG> or less. When length of run exceeds <MET>9000 mm</MET> <ENG>30 feet</ENG> and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than <MET>9000 mm</MET> <ENG>30 feet</ENG> may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than <MET>600 mm</MET> <ENG>24 inches</ENG> of coverage in place. SSSMR system with roofing panels greater than <MET>300 mm</MET> <ENG>12 inches</ENG> in

width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than [_____] <MET>mm. </MET><ENG>inches</ENG>.</TXT>

<SPT><TTL>2.1.1 Steel Panels</TTL>

<NTE><&AST

<NPR>NOTE: When panels have a factory color finish
remove last two sentences from this paragraph.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Zinc-coated steel conforming to <RID>ASTM A 653</RID>; aluminum-zinc alloy coated steel conforming to <RID>ASTM A 792</RID>, AZ 55 coating; or aluminum-coated steel conforming to <RID>ASTM A 463</RID>, Type 2, coating designation T2 65. Panels shall have a minimum thickness of <MET>0.61 mm</MET> <ENG>0.024 inch</ENG>, except that when the mid field of the roof is subject to design wind uplift pressures of <MET>2870 Pa</MET> <ENG>60 psf</ENG> or greater the entire roof system shall have a minimum thickness of <MET>0.76 mm.</MET> <ENG>0.030 inch.</ENG> Panels shall be within 95 percent of tested thickness. Prior to shipment, mill finish panels shall be treated with a passivating chemical to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.</TXT>

</SPT><SPT><TTL>2.1.2 Aluminum Panels</TTL>

<TXT INDENT=0 p>Alloy conforming to <RID>ASTM B 209</RID>, temper as required for the forming operation, shall be a minimum of <MET>0.81 mm</MET> <ENG>0.032 inch</ENG> thick.</TXT>

</SPT></SPT><SPT><TTL>2.2 _{CONCEALED ANCHOR CLIPS}</TTL>

<TXT INDENT=0 p>Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.</TXT>

</SPT><SPT><TTL>2.3 _{ACCESSORIES}</TTL>

<TXT INDENT=0 p>Accessories shall be compatible with the covering furnished. Flashing, trim, metal closure strips, caps, roof curbs, and similar metal accessories shall be not less than the minimum thicknesses specified for roofing panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be as recommended by the manufacturer.</TXT>

</SPT><SPT><TTL>2.4 _{FASTENERS}</TTL>

<NTE><&AST

<NPR>NOTE: Fasteners that are not color coated may be limited to 300-series corrosion resisting steel when warranted by atmospheric exposure conditions.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than <MET>3340 N</MET> <ENG>750 pounds</ENG> per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of <MET>10 </MET>mm<ENG>3/8 inch</ENG> for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately <MET>3 mm</MET> <ENG>1/8 inch</ENG> thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.</TXT>

<SPT><TTL>2.4.1 Screws</TTL>

<TXT INDENT=0 p>Screws for attaching anchor devices shall be not less than No. 14. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.</TXT>

</SPT><SPT><TTL>2.4.2 Bolts</TTL>

<TXT INDENT=0 p>Bolts shall be not less than <MET>6 mm</MET> <ENG>1/4 inch</ENG> diameter, shouldered or plain shank as required, with locking washers and nuts.</TXT>

</SPT><SPT><TTL>2.4.3 Structural Blind Fasteners</TTL>

<TXT INDENT=0 p>Blind screw-type expandable fasteners shall be not less than <MET>6 </MET>mm<ENG>1/4 inch</ENG> diameter. Blind (pop) rivets shall be not less than <MET>7 </MET>mm<ENG>9/32 inch</ENG> minimum diameter.</TXT>

</SPT></SPT><SPT><TTL>2.5 _{SUBPURLINS}</TTL>

<TXT INDENT=0 p>Subpurlins shall have a minimum thickness of <MET>1.50 mm</MET> <ENG>0.059 inches</ENG><ENG>and</ENG> a minimum yield strength of <MET>345 MPa.</MET> <ENG>50000 psi.</ENG></TXT>

</SPT><SPT><TTL>2.6 _{FACTORY COLOR FINISH}</TTL>

<NTE><&AST

<NPR>NOTE: Factory color finish will be specified except when the buildings are to be used for temporary purposes or where mill finish aluminum panels provide an acceptable appearance. If factory color finish is not required, document the rationale for the decision in the design analysis and remove this paragraph.</NPR>

<NPR>The standard finish coating in the US metal building industry is a nominal 0.025 mm (1 mil) thick, polyvinylidene fluoride (PVF2) based enamel. This

high performance coating is an excellent long life, maintenance-free finish which provides superior weathering and good corrosion protection. It is commonly used in mildly corrosive environments. For projects located in a more corrosive atmosphere or where a premium finish would otherwise be justified, a nominal 0.050 mm (2 mil) thick application is available. The thicker coating provides additional primer and increases the coating's corrosion and abrasion resistance. The 0.050 mm (2 mil) coating requires a special run by the coil coater and at least a 22 degrees C (70 degrees F) environment for roll forming. Additional delivery time should be anticipated.</NPR>

<NPR>For aggressive environments such as those involving direct contact with salt or chemical laden air or those that are highly abrasive, thick coatings (nominal 0.10 mm (4 mils) or more) utilizing PVF2 or urethane topcoats provide the best in color coat protection. The high cost of providing these thick film barriers for the purpose of preventing corrosion of galvanized steel panels, together with the fact that cut edges, scratches and penetrations of the panels expose the steel substrate, warrants consideration for the use of solid aluminum which is inherently less susceptible to damaging corrosion. Appropriate specification requirements must be added if thick film coatings are to be used.</NPR>

<NPR>Exterior wall and roof panels are available in several standard colors. Standard trim colors are usually more limited. Except where interior surfaces receive a factory color coat, the exposed reverse side of the panels normally are provided with an off-white backer coating. Color other than manufacturer's standard colors will be used only when the extra cost is justified.</NPR>

<NPR>The choice of coating for the interior face of panels depends on environmental and aesthetic considerations. Where a corrosive atmosphere is anticipated within the structure, the finish should be polyvinylidene fluoride in a thickness appropriate to the environment. For utilitarian facilities with little likelihood of a detrimental atmosphere, a standard backer coat is appropriate. Backer coat is the manufacturer's standard coating (usually polyester based) applied to the back side of the metal panel. This coating is controlled for consistent color, gloss and applied dry film thickness. Where interior surfaces are concealed behind insulation, liner panels, etc.; provide only a primer coat. These finishes should not be confused with a wash coat which is used primarily to facilitate the coil forming

process and which is not closely controlled for color, gloss or film thickness. The designer's rationale for using any special interior finish should be reflected in the design analysis.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer topcoat with an appropriate prime coat. Color shall match the color indicated [on the drawings] [in Section <SRF>09915</SRF> COLOR SCHEDULE]. The exterior coating shall be a nominal <MET>[0.025] [0.050] mm</MET><ENG>[1] [2] mil</ENG> thickness consisting of a polyvinylidene fluoride topcoat of not less than <MET>0.018 mm</MET><ENG>0.7 mil</ENG> dry film thickness and the paint manufacturer's recommended primer of not less than <MET>[0.005] [0.025] mm</MET><ENG>[0.2] [1.0] mil</ENG> thickness. Exposed to view interior color finish shall consist of [the same coating and dry film thickness as the exterior] [a nominal <MET>0.025 mm</MET><ENG>1 mil</ENG> thick polyvinylidene fluoride finish otherwise the same as the exterior] [a backer coat with a dry film thickness of <MET>0.013 mm</MET><ENG>0.5 mil</ENG>] [a <MET>0.005 mm</MET><ENG>0.2 mil</ENG> thick prime coat]. Interior face of panels not exposed to view may be provided with a mill finish or coated finish as specified above. The exterior color finish shall meet the test requirements specified below.</TXT>

<SPT><TTL>2.6.1 Salt Spray Test</TTL>

<NTE><&AST

<NPR>NOTE: The results of the salt spray test will vary depending on the thickness of the coating.</NPR>

<NPR>0.025 mm (1 mil) coating: 8F (few no. blisters) and 6 (3 mm (1/8 inch) max creep at scribe).</NPR>

<NPR>0.050 mm (2 mil) coating: 10 (no blistering) and 8 (1 mm (1/32 inch) max failure from scribe).</NPR>

<&AST

</NTE><TXT INDENT=0 p>A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with <RID>ASTM B 117</RID>, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of [not less than 8F, few No. 8 blisters,] [10, no blistering,] as determined by <RID>ASTM D 714</RID>; and a rating of [6, <MET>3 mm</MET><ENG>1/8 inch</ENG>] [8, <MET>1 mm</MET><ENG>1/32 inch</ENG>] failure at scribe, as determined by <RID>ASTM D 1654</RID>.</TXT>

</SPT><SPT><TTL>2.6.2 Formability Test</TTL>

<TXT INDENT=0 p>When subjected to testing in accordance with <RID>ASTM D 522</RID>, the coating film shall show no evidence of fracturing to the naked eye.</TXT>

</SPT><SPT><TTL>2.6.3 Accelerated Weathering, Chalking Resistance and Color Change</TTL>

<NTE><&AST

<NPR>NOTE: Low gloss finishes have relatively poor weathering qualities. Delete the last sentence if a low gloss finish is not required by Paragraph Specular Gloss.</NPR>

<&AST

</NTE><TXT INDENT=0 p>A sample of the sheets shall be tested for a minimum of 1000 hours in accordance with <RID>ASTM G 23</RID>, Method 2, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with <RID>ASTM D 3359</RID>, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with <RID>ASTM D 4214</RID> test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with <RID>ASTM D 2244</RID>. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.</TXT>

</SPT><SPT><TTL>2.6.4 Humidity Test</TTL

<TXT INDENT=0 p>When subjected to a humidity cabinet test in accordance with <RID>ASTM D 2247</RID> for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.</TXT>

</SPT><SPT><TTL>2.6.5 Impact Resistance</TTL

<TXT INDENT=0 p>Factory-painted sheet shall withstand direct and reverse impact in accordance with <RID>ASTM D 2794</RID> equal to 1.5 times metal thickness in <MET>mm,</MET> <ENG>mils,</ENG> expressed in <MET>newton-meter,</MET> <ENG>inch-pounds,</ENG> with no loss of adhesion.</TXT>

</SPT><SPT><TTL>2.6.6 Abrasion Resistance Test</TTL

<NTE><&AST

<NPR>NOTE: The 70 percent polyvinylidene fluoride finish has a minimum abrasion resistance of about 65 liters per 0.025 mm (65 liters/mil) of coating thickness. The nominal 0.025 mm (1 mil) finish will withstand 50 to 60 liters of sand while the nominal 0.050 mm (2 mil) finish can be expected to withstand 80-100 liters. The results of this test are variable and offer poor repeatability. In shop drawing review, notice the difference between the specified total liters of sand and those reported.</NPR>

<&AST

</NTE><TXT INDENT=0 p>When subjected to the falling sand test in accordance with <RID>ASTM D 968</RID>, the coating system shall withstand a minimum of [50] [80] liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.</TXT>

</SPT><SPT><TTL>2.6.7 Specular Gloss</TTL

<NTE><&AST

<NPR>NOTE: Few manufacturers regularly produce prefinished panels meeting these low gloss requirements and such sheets are available only in limited colors. Standard 70 percent polyvinylidene fluoride finish has a medium gloss. Low gloss paint formulations result in reduced weathering properties. Identify individual facilities requiring low gloss finish. For roof of structures at airfields where glare would be objectionable and may be an operational hazard, the specular gloss value should be limited to 10 or less at an angle of 85 degrees. If low gloss color finish is not specified remove this paragraph.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Finished roof surfaces for [_____] shall have specular gloss value of 10 or less at an angle of 85 degrees when measured in accordance with <RID>ASTM D 523</RID>.</TXT>

</SPT><SPT><TTL>2.6.8 Pollution Resistance</TTL

<TXT INDENT=0 p>Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with <RID>ASTM D 1308</RID>.</TXT>

</SPT></SPT><SPT><TTL>2.7 _{INSULATION}</TTL>

<NTE><&AST

<NPR>NOTE: Drawings will show type, extent, and location of insulation. This Section covers four systems based upon the location of the insulation and the vapor retarder. The insulation location is dependent upon the use or absence of a separate roof deck. The vapor retarder location is dependent on the climate as noted in paragraph VAPOR RETARDER.</NPR>

<NPR>The required R-value for the insulation will be determined and shown at the appropriate details on the drawings. The required R-values for the insulation will never be less than the R-values used in the Energy Budget Analysis. The R-values shown on the drawings should be greater than those used in the design analysis to account for thermal bridges. Provide about a one-third increase (or as local experience has shown, if different) in R-value over what is calculated; that is, if an R-value of 3 is needed in metric (metric units are square meter K/W) (16 in I-P with units of h x square feet x degree F/Btu) use an R-value of 4 (21) in the contract. If an analysis of thermal bridges in the design gives a requirement greater or less than this, it should be used.</NPR>

<NPR>Flame spread rating of 75 or less and smoke development rating of 150 or less should be used when insulation is enclosed with noncombustible materials. Flame spread and smoke development ratings of exposed insulation, to include facing, shall comply with the requirements of MIL HDBK 1008B. Exposed insulation shall be faced, mineral fiber type, only; cellular plastic insulations shall not be exposed.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of <MET>24 degrees C</MET> <ENG>75 degrees F</ENG> in accordance with <RID>ASTM C 518</RID>. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. [Blanket insulation shall have a facing as specified in paragraph VAPOR RETARDER]. Insulation [, including facings,] shall have a flame spread not in excess of [_____] and a smoke developed rating not in excess of [_____] when tested in accordance with <RID>ASTM E 84</RID>. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.</TXT>

<SPT><TTL>2.7.1 Rigid Board Insulation for Use Above a Roof Deck</TTL>

<SPT><TTL>2.7.1.1 Polyurethane or Polyisocyanurate</TTL>

<TXT INDENT=0 p>Polyurethane or polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per <MET>25 mm</MET> <ENG>1 inch</ENG> of insulation used shall be <MET>1.27.</MET> <ENG>7.2.</ENG></TXT>

</SPT><SPT><TTL>2.7.1.2 Mineral Fiber</TTL>

<TXT INDENT=0 p>Insulation shall conform to <RID>ASTM C 612</RID>.</TXT>

</SPT></SPT><SPT><TTL>2.7.2 Blanket Insulation</TTL>

<NTE><&AST

<NPR>NOTE: The specified blanket insulation is flexible mineral fiber insulation for use at temperatures up to 176 degrees C (350 degrees F).</NPR>

<&AST

</NTE><TXT INDENT=0 p>Blanket insulation shall conform to <RID>ASTM C 553</RID>.</TXT>

</SPT></SPT><SPT><TTL>2.8 INSULATION RETAINERS</TTL>

<TXT INDENT=0 p>Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used

in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.</TXT>

</SPT><SPT><TTL>2.9 _{SEALANT}</TTL>

<TXT INDENT=0 p>Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be [colored to match the applicable building color] [clear] and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.</TXT>

</SPT><SPT><TTL>2.10 _{GASKETS AND INSULATING COMPOUNDS}</TTL>

<TXT INDENT=0 p>Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.</TXT>

</SPT><SPT><TTL>2.11 VAPOR RETARDER</TTL>

<NTE><AST

<NPR>NOTE: The term vapor retarder has been selected to describe the membrane used to reduce moisture vapor transmission. The location of the vapor retarder is determined by the climate and the building type.</NPR>

<NPR>The vapor retarder goes on the side of the insulation with the greatest vapor pressure during the course of the year, therefore it goes on the outside in a climate predominately warm, and on the inside in a climate predominately cool. The designer should determine the most appropriate application/installation of the vapor retarder based on project circumstances. See TM 5-810-1 for humid climate definition.</NPR>

<NPR>Detail the use of insulation on the drawings. The four systems are as follows:</NPR>

<NPR>a. Cool climate, no roof deck. The vapor retarder will be a facing on the bottom of blanket insulation.</NPR>

<NPR>b. Warm climate, no roof deck. The vapor retarder will be a facing on the top of blanket insulation with a separate insulation support system. A slip sheet is required. If the integral facing is used to support the insulation, a separate polyethylene vapor retarder must be laid over the insulation.</NPR>

<NPR>c. Cool climate, with a roof deck. The vapor retarder will be a separate membrane directly on top of the roof deck with board insulation over the vapor

retarder and an unfaced blanket cushioning between the board insulation and the roofing.</NPR>

<NPR>d. Warm climate, with a roof deck. The vapor retarder will be a facing on the top of a blanket insulation above board insulation. The board insulation sits on the roof deck. A slip sheet is required.</NPR>

<NPR>Unreinforced foil as the facing in conditions and d, above, should not be used.</NPR>

<&AST

</NTE><SPT><TTL>2.11.1 Vapor Retarders as Integral Facing</TTL

<TXT INDENT=0 p>Insulation facing shall have a permeability of <MET>[5.7] [1.15] [_____] ng per Pa-second-square meter</MET> <ENG>[0.1] [0.02] [_____] perm</ENG> or less when tested in accordance with <RID>ASTM E 96</RID>. Facing shall be [white] [gray] [green] [of reinforced foil with a vinyl finish] [sheet vinyl] [; except that unreinforced foil with a natural finish may be used in concealed locations]. Facings and finishes shall be factory applied.</TXT>

</SPT><SPT><TTL>2.11.2 Vapor Retarders Separate from Insulation</TTL

<NTE><&AST

<NPR>NOTE: Steel deck should not be assumed to function as a vapor retarder.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Vapor retarder material shall be polyethylene sheeting conforming to the requirements of <RID>ASTM D 4397</RID>. A single ply of <MET>0.25 mm</MET> <ENG>10 mil</ENG> <ENG>polyethylene</ENG> sheet; or, at the option of the Contractor, a double ply of <MET>0.15 mm</MET> <ENG>6 mil</ENG> polyethylene sheet shall be used. A fully compatible polyethylene tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.</TXT>

</SPT><SPT><TTL>2.11.3 Slip Sheet for Use With Vapor Retarder</TTL

<NTE><&AST

<NPR>NOTE: A slip sheet is required to separate the roofing panels from the insulation facing where the facing would be in direct contact with the roofing panels.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Slip sheet for use with vapor retarder shall be <MET>0.24 kg per square meter</MET> <ENG>5 per 100 square foot</ENG> rosin-sized, unsaturated building paper.</TXT>

</SPT></SPT><SPT><TTL>2.12 _{EPDM RUBBER BOOTS}</TTL>

<TXT INDENT=0 p>Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber.

Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.</TXT>

</SPT></PRT><PRT><TTL>PART 3 EXECUTION</TTL>

<SPT><TTL>3.1 INSTALLATION</TTL>

<TXT INDENT=0 p>Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever covering sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.</TXT>

<SPT><TTL>3.1.1 Field Forming of Panels</TTL>

<TXT INDENT=0 p>Roofing panels may be formed from factory-color-finished steel coils at the project site, in which case the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.</TXT>

</SPT><SPT><TTL>3.1.2 Subpurlins</TTL>

<TXT INDENT=0 p>Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. The subpurlin spacing shall not exceed <MET>750 mm</MET> <ENG>30 inches</ENG> on centers at the corner, edge and ridge zones, and <MET>1500 mm</MET> <ENG>5 foot</ENG> maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in <RID>ASCE 7</RID>.</TXT>

</SPT><SPT><TTL>3.1.3 Roof Panel Installation</TTL>

<TXT INDENT=0 p>Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture covering sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.</TXT>

</SPT><SPT><TTL>3.1.4 Concealed Anchor Clips</TTL

<TXT INDENT=0 p>Concealed anchor clips shall be fastened directly to the structural framing members. The maximum distance, parallel to the seams, between clips shall be <MET>750 mm</MET> <ENG>30 inches</ENG> on center at the corner, edge, and ridge zones, and <MET>1500 mm</MET> <ENG>5 feet</ENG> maximum on centers for the remainder of the roof.</TXT>

</SPT></SPT><SPT><TTL>3.2 INSULATION INSTALLATION</TTL

<NTE><&AST

<NPR>NOTE: Choose one paragraph and delete the other. Use rigid or semirigid board insulation with a roof deck. Use blanket insulation without a roof deck.</NPR>

<&AST

</NTE><TXT INDENT=0 p>Insulation shall be installed as indicated and in accordance with manufacturer's instructions.</TXT>

<SPT><TTL>3.2.1 Board Insulation with Blanket Insulation</TTL

<TXT INDENT=0 p>Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.</TXT>

</SPT><SPT><TTL>3.2.2 Blanket Insulation</TTL

<TXT INDENT=0 p>Blanket insulation shall be installed over the purlins and held tight against the metal roofing. It shall be supported by an integral facing or other commercially available support system.</TXT>

</SPT></SPT><SPT><TTL>3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK</TTL>

<NTE><&AST

<NPR>NOTE: Delete this paragraph if the vapor retarder will not be in direct contact with the roof deck.</NPR>

<&AST

</NTE><TXT INDENT=0 p>A cloth industrial duct tape shall be adhered over all the seams of metal roof decking, at any penetration edges, and at all surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decking, cloth industrial duct tape shall be adhered over all irregularities which could potentially puncture polyethylene membrane.</TXT>

</SPT><SPT><TTL>3.4 VAPOR RETARDER INSTALLATION</TTL

<NTE><&AST

<NPR>NOTE: Choose one paragraph and delete the other.</NPR>

<&AST

</NTE><SPT><TTL>3.4.1 Integral Facing on Blanket Insulation</TTL

<TXT INDENT=0 p>Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.</TXT>

</SPT><SPT><TTL>3.4.2 Polyethylene Vapor Retarder</TTL

<TXT INDENT=0 p>The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than <MET>150 mm.</MET> <ENG>6 inches.</ENG> Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.</TXT>

</SPT></SPT><SPT><TTL>3.5 SLIP SHEET INSTALLATION</TTL

<NTE><&AST

<NPR>NOTE: Delete this paragraph if no blanket insulation facing will be compressed against metal roofing.</NPR>

<&AST

</NTE><TXT INDENT=0 p>A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.</TXT>

</SPT><SPT><TTL>3.6 CLEANING AND TOUCH-UP</TTL

<TXT INDENT=0 p>Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.</TXT>

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